Deadtime Analysis Updates

DVCS Collaboration meeting
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Salina Ali

Overview

- Determine deadtime from dedicated run 13418 at 10, 15, 20 μA.
- Check if live and raw scalers used are reliable for deadtime.
  - Live & raw scalers checked: S2M&&Cerenkov, Master OR, EDTM, S2m, S0.
  - Current dependence problem arises- started looking at CODA-event based rates.
- Find a way to minimize current dependence of DVCS normalized rates.
  - Accidentals: look into Calorimeter and LHRS coincidence time to obtain an accidental rate based on clustering information.
  - Determine signal/background ratio from coincidence time distribution spectra from each 3 currents during the run.
  - Scaling of ADC gate width is not needed.

Deadtime Computations

- **Looking at scaler rates: live and raw**

$$Raw\ rate = Live\ rate \cdot \frac{1}{1 - Deadtime}$$

- **Livetime and deadtime:**

$$Livetime = \frac{Live\ Scaler\ Rate}{Raw\ Scaler\ Rate}$$

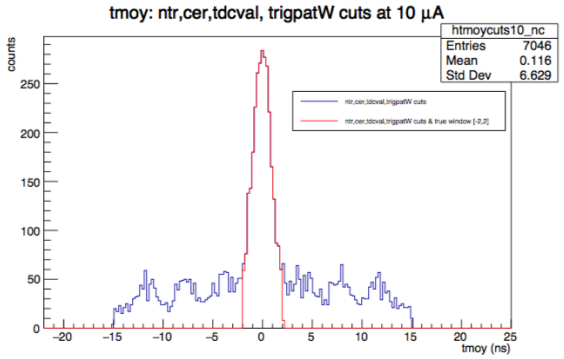
$$Deadtime = 1 - Livetime$$

DVCS and DIS normalized rates

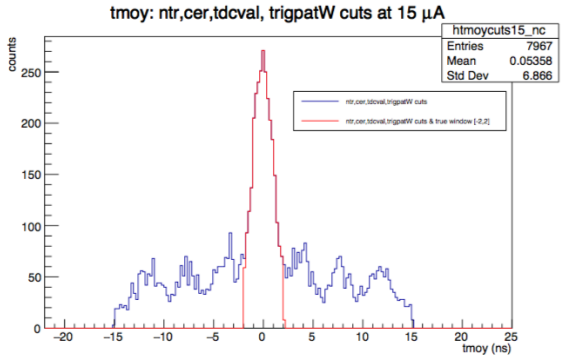
		Normalized Rates (Hz/μA)							
I(μA)	S2M &Cer LT	No cuts	Trk	Trk& TDC	Trk&TDC& Cer	Trk&TDC &Cer& DIS	Trk&TDC& Cer&DIS/ S2M&CER LT	Trk&TDC& Cer&DVCS	Trk&TDC&Cer&DVCS/S2M &CER LT
10.61	0.985	9.27	5.783	5.719	5.138	3.365	3.422	5.134	5.212
15.32	0.976	10.26	6.192	6.117	5.484	3.356	3.450	5.480	5.615
20.53	0.965	11.26	6.459	6.391	5.733	3.321	3.449	5.728	5.936

- Rates given in Hz/μA, with the following cuts from the root tree:
  - Trk: tracking cut, given by "L.tr.n" >0
  - TDC: Time-to-Digital Converter, given by tdc_val[27]-tdc_val[7]/10<-24
  - CER: Cerenkov cut, given by "L.cer >500"
  - DIS: given by "triggerPatternWord&0x00080"
  - DVCS: given by "triggerPatternWord&0x00100"

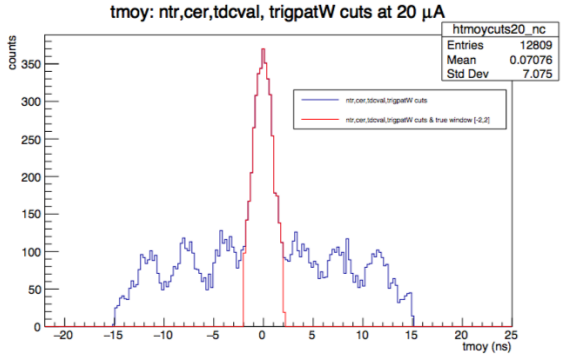
Contribution of accidentals: Time Coincidence Spectra (tmoy) for DVCS



(a)



(b)

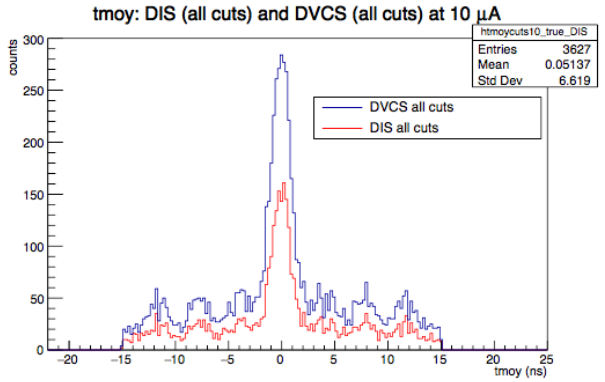


(c)

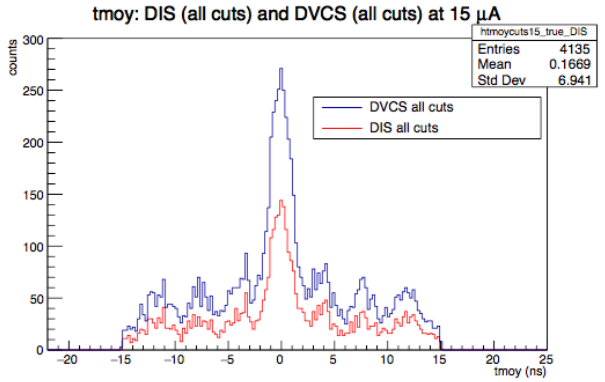
- tmoy was extracted from root tree and same cuts applied for DVCS rates were applied to get a Signal/Total ratio.
- Signal/Total ratio applied to DVCS rates resulted in current dependence at ~6%.

tmoy Comparison: DVCS vs. DIS cuts

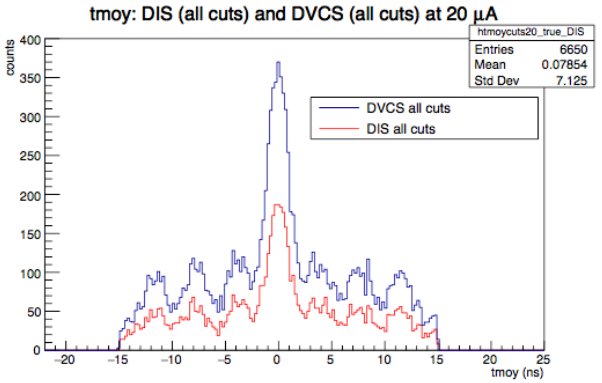
- Suggestion – look at DIS triggers instead: determine a signal/total ratio and apply to DVCS rates.
  - Same cuts as before but with DIS triggerPatternWord cut, not DVCS triggerPatternWord.



(a)



(b)

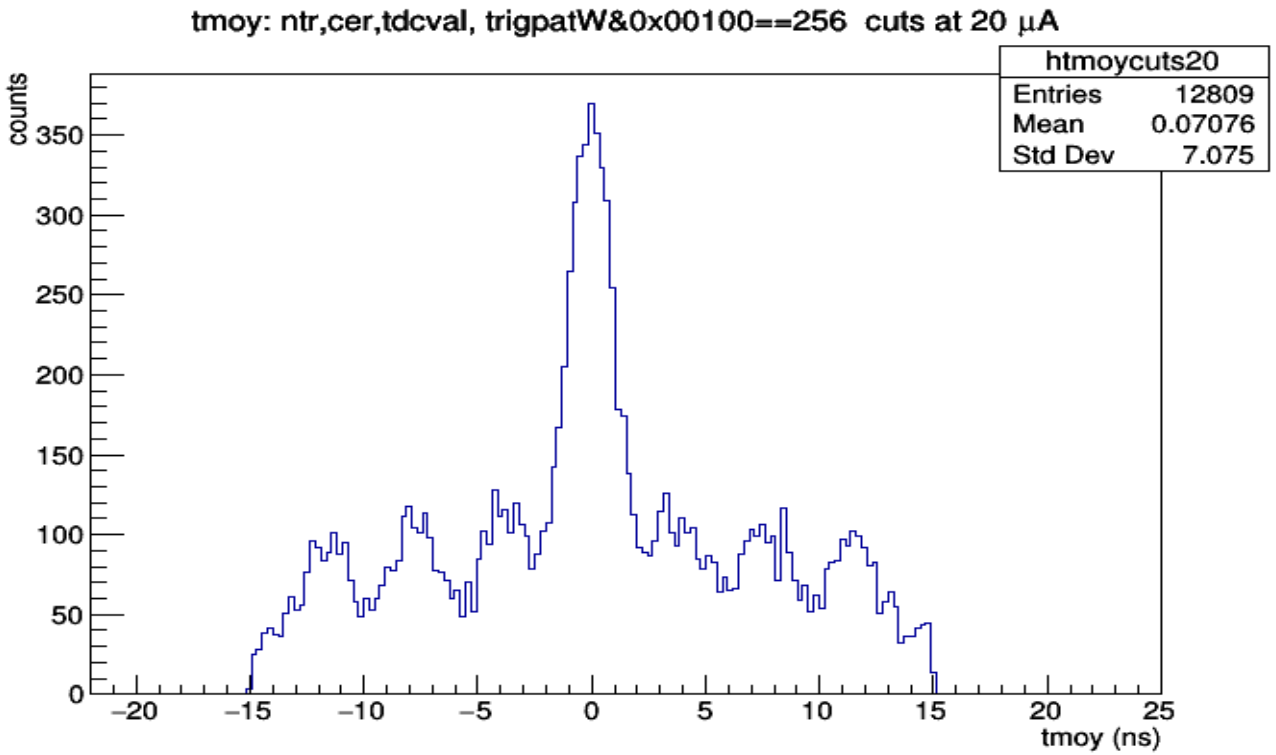


(c)

Subtracting accidental rates

$$Real\ coincidences\ (signal) = Integral\ over\ main\ coincidence\ peak\ (total)\ - Integral\ over\ accidental\ 4\ ns\ peak\ (accidentals)$$

$$Integral\ over\ main\ coincidence\ peak\ (total) = Signal + Background$$



$$\frac{Signal}{Total} = \frac{Real\ Coincidences}{Integral\ over\ main\ coincidence\ peak}$$

Subtracting accidental rates

1) $$DIS\ signal\ to\ total\ ratio\ for\ each\ \mu A = \frac{Real\ Coincidences}{Integral\ over\ main\ coincidence\ peak}$$

2) $$DVCS\ normalized\ rate\ corrected = \frac{DVCS\ rate\ (Hz) \times DIS\ signal\ to\ total\ ratio}{I\ (\mu A) \times S2M\&\&Cer\ LT}$$

Sample Calculation: $$DVCS\ corrected\ normalized\ rate\ at\ 10\ \mu A = \frac{54.47\ \frac{Hz}{\mu A} \times 0.7889}{10.61\ \mu A \times 0.985} = 4.111\ \frac{Hz}{\mu A}$$

I (μA)	S2M&& Cer	Rate: no cuts (Hz/μA)	DIS Normalized rate (Hz/μA)	DVCS Norm Rate (Hz/μA)	DVCS (all cuts) Signal/ Total	DIS (all cuts) Signal/ Total	DVCS Norm rates corrected (Hz/μA)
10.61	0.985	9.27	3.422	5.212	0.7915	0.7889	4.111
15.32	0.976	10.36	3.450	5.615	0.7397	0.7470	4.194
20.53	0.965	11.26	3.449	5.936	0.6547	0.6507	3.863

$$DIS\ signal\ to\ total\ ratio\ for\ each\ \mu A = \frac{Real\ Coincidences}{Integral\ over\ main\ coincidence\ peak}$$

~6% difference per 10 μA

$$DVCS\ normalized\ rate\ corrected = \frac{DVCS\ rate\ (Hz) \times DIS\ signal\ to\ total\ ratio}{I\ (\mu A) \times S2M\&\&Cer\ LT}$$

$$DVCS\ corrected\ normalized\ rate\ at\ 10\ \mu A = \frac{54.47\ \frac{Hz}{\mu A} \times 0.7889}{10.61\ \mu A \times 0.985} = 4.111\ \frac{Hz}{\mu A}$$

Outlook

- Next: resolve the remaining current dependence observed in DVCS data
  - Check background subtraction method again?